

NSF / EPA

Technologies for a Sustainable Environment  
2000 - 2003

and other activities  
in EBDM

D. Durham  
NSF, 2005

# TSE and beyond in NSF / DMII

ECM 1995 -  
present

**NSF / EPA**

'96 – 5 awards in DMII  
'97 – 1 award  
'99 – 4 awards  
'02 – 24 proposals 8 awards  
'03 – 3 topics, 77 proposals

1997 -  
present

**EBM / Programs**

Unsolicited – increasing %

2002-  
2004

**PREMISE DMII**

83 proposals, 13 awards  
4 large group awards

2002

**MUSES**

'02 – 24 smalls, 11 awards  
'03 – 4 / 13 large, 5/6 small  
'04 – 2 /16 large, 5 small

# NSF/EPA 2000 22 proposals

## FY 99-00 - Technology for a Sustainable Environment Division of Design, Manufacture, and Industrial Innovation

Project Title	Principal Investigator Institution	State	NSF Number	NSF Funding	EPA Number	Division
Investigation of a Novel Capillary Non-Thermal Ambient Pressure Plasma for Cleaning Aluminum Surfaces	George Korfiatis Stevens Institute of Technology	NJ	9985359	(70,000) 349,943		DMI
Use of Ambient Non-thermal Plasma in Manufacturing	Shirak Dhali Southern Illinois University at Carbondale	IL	9985604	(75926) 240,000		DMI
Superheated Water and Steam Degreasing of Working Stocks, Parts, and Equipment in Machining, Manufacturing and Production Processes and Operations	Walter J. Weber University of Michigan	MI	9985423	\$160,000	R828246	DMI

EPA funded two additional projects – total funding 5 /22

# FY 2001 NSF/EPA TSE

<b>Proposal</b>	<b>PI</b>	<b>Institution</b>	<b>Title</b>
<b>0124686</b>	<b>Boerio</b>	<b>U Cincinnati,</b>	<b>Plasma Polymerization: A Novel, Environmentally-Compatible Process for Surface Engineering of Metals (TSE01-I)</b>
<b>0124759</b>	<b>Cannon</b>	<b>Penn State</b>	<b>Diminishing materials use and air pollutants in foundries via an integrated advanced oxidation process: Characterization of materials and pollutants at the nano-scale (TSE01-I)</b>
<b>0124789</b>	<b>Drzal</b>	<b>Michigan State</b>	<b>Sustainable Composite Materials from Renewable Resources for Automotive Applications</b>
<b>0124694 0124730</b>	<b>Hirsa / Steen</b>	<b>RPI / Cornell</b>	<b>Collaborative Research: Environmentally Benign Manufacturing: Casting by Design</b>
<b>0124441</b>	<b>Meng</b>	<b>Louisiana State</b>	<b>High Temperature Micromolding of Aluminum Parts</b>
<b>0124746</b>	<b>Plesniak</b>	<b>Purdue University</b>	<b>Flow Control and Design of Environmentally Benign Spray Systems (TSE01-E) (TSE01-I)</b>
<b>0124728</b>	<b>Wool</b>	<b>U Delaware,</b>	<b>Composite Resins and Adhesives from Plants (TSE01-I)</b>

22 proposals reviewed by DMI / 6 funded by NSF & EPA

# 2003 NSF/EPA Environmental Technologies and Systems formerly Technologies for a Sustainable Environment

2003 Environmentally Benign Systems and Design,  
Manufacturing, Processing, and Industrial Ecology for  
Sustainable Product / Services Realization

- Life-cycle assessment
- Green Design and Materials Cycles
- Environmentally Benign Manufacturing

# 2003 NSF/EPA

NSF no.	PI Last name	Proposal Title	
327914	Theis	Life Cycle Analysis of Biolubricants for Aluminum Rolling	EPA
327974	Wong	Environmentally Benign Lead-Free Electrically Conductive Adhesive for Electronic Packaging Manufacturing	EPA
328030	Hayes	Design of Novel Petroleum-Free Metalworking Fluids	EPA
334315	Manke, Jr.	Carbon Dioxide Soluble Binders for Environmentally Benign Metal Forming Operations	EPA
328153	Hershkowitz	A New Approach for Reducing Global Warming Emissions from Plasma Etching by Controlling Ion Energy and Neutral Flux	EPA
328194	Dornfeld	Comprehensive Tools to Assess Environmental Impacts of and Improve the Design of Semiconductor Equipment and Processes	EPA
323426	Gutowski	Environmental Analysis of Manufacturing Processes	NSF
328090	Sawyer, Wallace	(TSE03-K) In Situ Solid Lubricant Deposition: A New Technology for Environmentally Benign Machining	NSF
328071	Hendrickson,	(TSE03-H) Assessment Tool and Visualization for Regional Supply Chain Impacts	NSF
0328134	Linninger,	Clean Batch Manufacturing with Uncertainty Management (TSE03-K)	NSF

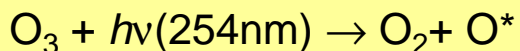
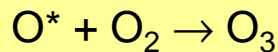
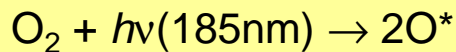
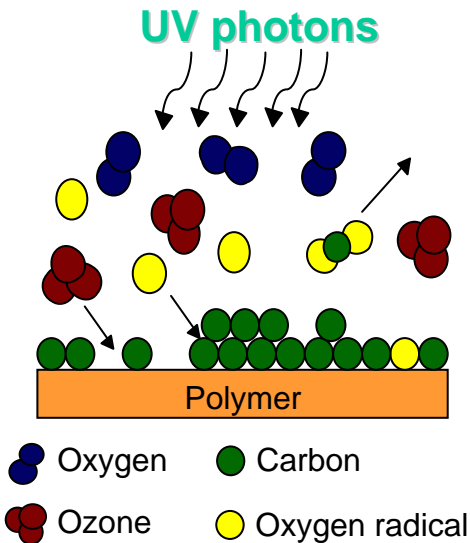
DMI set up 3 panels on Green Design, Green Enterprise Systems  
And Green technologies and processes – 77 proposals

# Ultraviolet (UV) Light Surface Treatment of Polymers: An Environmentally Benign Manufacturing Process for Enhanced Paint and Adhesive Performance

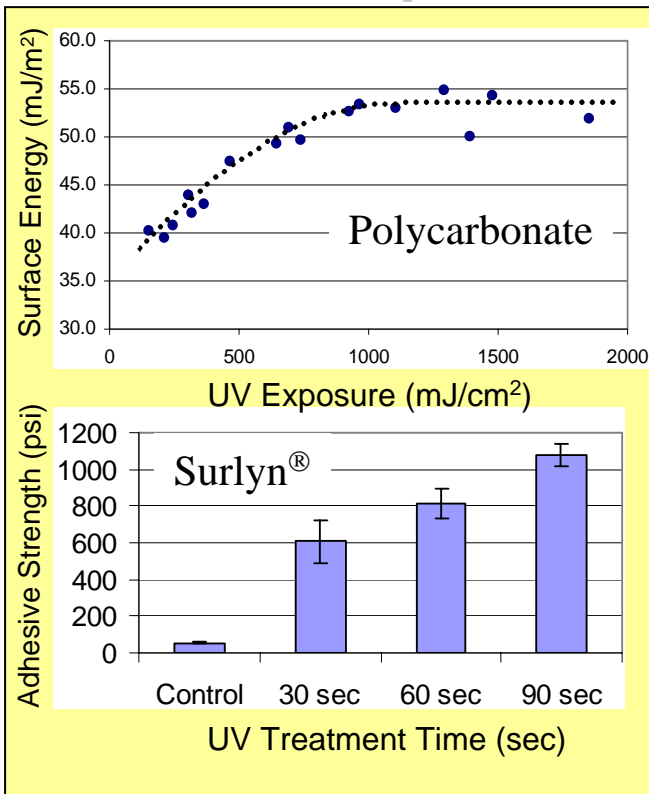
**Objective:** to investigate the effectiveness of pulsed, UV light in air as an environmentally benign technology to clean and functionalize polymer surfaces, for adhesive bonding and painting

## Enhanced Properties

## Benefits



*Ozone and oxygen radicals formed by UV light create a strong oxidizing environment*



*Increase in surface energy improves wettability and adhesive bond strength*

- *Low cost process*
- *Fast treatment times (10-120 sec)*
- *Environmentally benign dry process eliminates use of chemical solutions*
- *No emission of VOCs*
- *Operation at ambient temperature and pressure*
- *Performance competitive with Plasma, Corona, Chemical and Flame treatments*
- *Low labor and waste disposal costs*
- *Easy integration in manufacturing environment*

# Development of Mimosa as a Materials Substitute for Hardwood Fibers in Paper Manufacturing

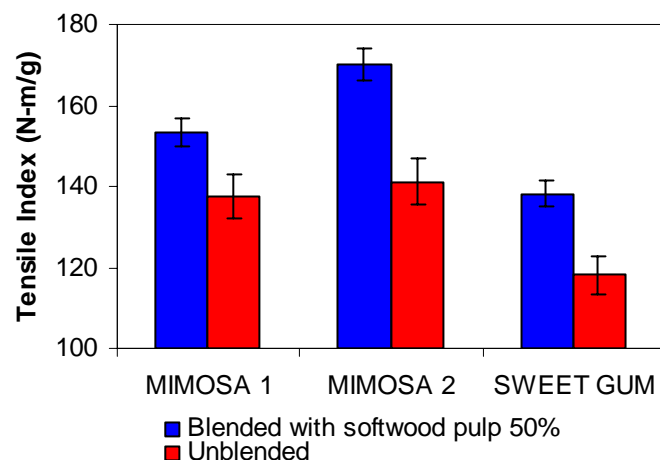
(S. R. Duke, Auburn University)

**Objective:** Develop the new technologies needed in paper processing and agronomy to make mimosa (*Albizia julibrissin*) a viable materials substitute for hardwood fibers in fine paper manufacturing

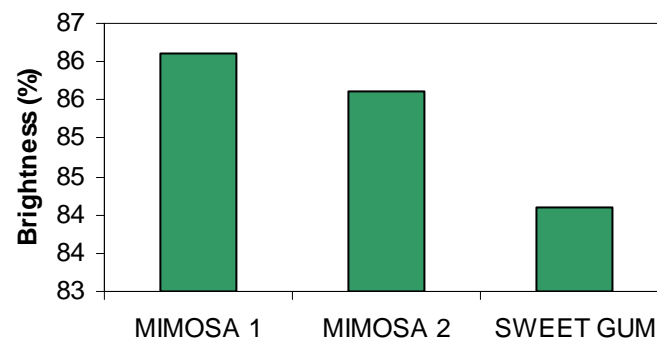
**Impacts:** Reduction in harvesting of hardwoods in old growth forests; Lower energy usage during manufacturing with anticipated ease of pulping, bleaching, and refining of the mimosa fibers



*Mimosa fibers have strength properties similar to hardwood fibers*



*Bleaching response of mimosa fibers is higher than gum fibers*







# Analytical Modeling for Demanufacturing Operations

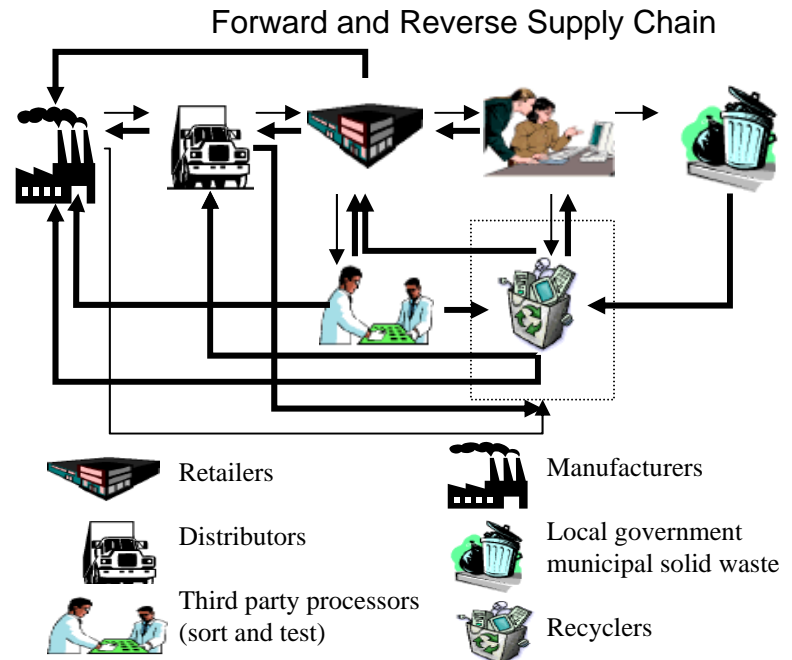
Julie Ann Stuart

Purdue University

Defining demanufacturing metrics and developing models to improve reverse production planning decisions.

New algorithms improve customer service, product reuse, and materials recycling.

Models may assist policy makers in evaluating proposed legislation for product take-back.



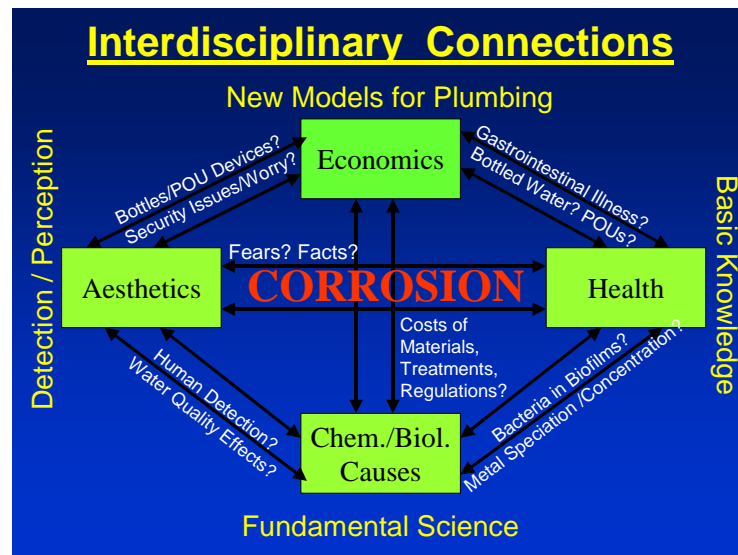


## Beyond TSE – the BE:MUSES activity

# Towards a Sustainable Potable Water Infrastructure: Ecology, Aesthetics and Economics of Corrosion



Virginia Polytechnic Institute



Marc Edwards, Andrea Dietrich, Darrel Bosch , G. Vasudevan Loganathan ,  
Susan Duncan , Sharon Dwyer , Tamin Younos et al